

*Arabidopsis thaliana* FAE1 (SEQ ID NO:2)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNPN REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTVR  
THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYPVD FKLAVDHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKNAW  
QIALGSGFKC NSAVWVALRN VKASANSPWQ HCIDRYPVKI DSDLSSKSKTH  
VQNGRS

*Brassica napus* elongase KCS (SEQ ID NO:4)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLQ  
HNLITIAPLF AFTVFGSVLYI IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFK DKIKHYYPVD FKLADHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKKNVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

*B. napus* elongase KCS (SEQ ID NO:6)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYLTIDDL HHLYYSYLQH  
NLITIAPLLA FTVFGSVLYI ATRPKPVYLV EYSCYLPPTH CRSSISKVMD  
IFFQVRKADP SRNGTCDDSS WLDFLRKIQE RSGLGDETHG PEGLLQVPPR  
KTFARAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
MVVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVVSTE  
NITYNIYAGD NRSMMVSNC LFRVGGAAILL SNKPRDRRRS KYELVHTVRT  
HTGADDKSFR CVQQGDDENG QTGVSLSKDI TDVAGRTVKK NIATLGPLIL  
PLSEKLLFFV TFMGKKLFDK EIKHYYPDF KLAIDHFCIH AGGKAVIDVL  
EKNLGLAPID VEASRSTLHR FGNTSSSSIW YELAYIEPKG RMKKGNKVVWQ  
IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
PNGRS

FIGURE 1-1

At114 (SEQ ID NO:8)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNGTCDD S WLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFK DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKNKVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VPNGRS

At74 (SEQ ID NO:10)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPKPVYLV EYSCYLPPTH CRSSISKVMD  
 IFYQVRKADP SRNGTCDDSS WLDFLRKIQE RSGLGDETHG PEGLLQVPPR  
 KTFAAAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
 MVVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVVSTE  
 NITYNIYAGD NRSMMVSNCL FRVGGAAILL SNKPGDRRRS KYELVHTVRT  
 HTGADGKSFR CVQQGDDENG KIGVSLSKDI TDVAGRTVKK NIATLGPLIL  
 PLSEKLLFFV TFMGKKLFKD KIKHYYPVDF KLAIIDHFCIH AGGRAVIDVL  
 EKNLALAPID VEASRSTLHR FGNTSSSSIW YELAYIEAKG RMKKGNKVWQ  
 IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
 QNGRS

At114 L91C K92R (SEQ ID NO:12)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **CRVSVSKVMD**  
 IFYQIRKADT SSRNGTCDNS WLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFK DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKNKVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VPNGRS

FIGURE 1-2

At114 K92R (SEQ ID NO:14)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **L**RVSVSKVMD  
 IFYQIRKADT SSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFF DKIKHYVPD FKLAIHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKQVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VPNGRS

At114 G307D (SEQ ID NO:16)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVS**V**SKVMD  
 IFYQIRKADT SSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**D**KSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFF DKIKHYVPD FKLAIHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKQVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VQNGRS

At74 G306D (SEQ ID NO:18)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPKPVYLV EYSCYLPPTH CRSSISKVMD  
 IFYQVRKADP SRNGTCDDSS WLD**F**LRKIQE RSGLGDETHG PEGLLQVPPR  
 KTFAAAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
 MVVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVVSTE  
 NITYNIYAGD NRSMMSVNC LFRVGGAAIL LSNKPGDRRRS KYELVHTVRT  
 HTGAD**D**KSFR CVQQGDDENG KIGVSLSKDI TDVAGRTVKK NIATLGPLIL  
 PLSEKLLFFV TFMGKKLFFD KIKHYVPDF KLAIDHFCIH AGGRAVIDVL  
 EKNLALAPID VEASRSTLHR FGNTSSSSIW YELAYIEAKG RMKKKGKQVWQ  
 IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
 QNGRS

FIGURE 1-3

At114 L91C K92R G307D (SEQ ID NO:20)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **CR**VSVSKVMD  
 IFYQIRKADT SSRNGTCDNS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**DK**SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFK DKIKHYVVPD FKLAI DHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKQVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCDRYPVKI DSDSGKSETR  
 VQNGRS

At114 K92R G307D (SEQ ID NO:22)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **LR**VSVSKVMD  
 IFYQIRKADT SSRNGTCDNS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**DK**SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFK DKIKHYVVPD FKLAI DHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKQVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCDRYPVKI DSDSGKSETR  
 VQNGRS

At254 (SEQ ID NO:24)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNLLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
 RKTFAASREE TEKVIIGALE NLFENTKVNPN REIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFK DKIKHYVVPD FKLAI DHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKQVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCDRYPVKI DSDSGKSETR  
 VPNGRS

FIGURE 1-4

At173 (SEQ ID NO:26)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
 RKTFAASREE TEKVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLKF DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VQNGRS

Bn176 (SEQ ID NO:28)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLQ  
 HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
 DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTKVNP REIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTVR  
 THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
 LPLSEKFLFF ATFVAKKLLK DKIKHYYPVD FKLAVDHFCI HAGGRAVIDE  
 LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKAW  
 QIALGSGFKC NSAVWVALRN VKASANSPWQ HCIDRYPVKI DSDLSKSKTH  
 VQNGRS

At399 (SEQ ID NO:30)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
 RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTVR  
 THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
 LPLSEKFLFF ATFVAKKLLK DKIKHYYPVD FKLAVDHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKVW  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VQNGRS

FIGURE 1-5

Bn399 (SEQ ID NO:32)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLQ  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAI DHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKAW  
QIALGSGFKC NSAVWVALRN VKASANS PWQ HCIDRYPVKI DSDLSKSKTH  
VQNGRS

Bn G307D (SEQ ID NO:34)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLQ  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGAD**D**KSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAI DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

At K92R (SEQ ID NO:36)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **L**RVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTVR  
THTGAD**D**KSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYPV FKLAV DHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKAW  
QIALGSGFKC NSAVWVALRN VKASANS PWQ HCIDRYPVKI DSDLSKSKTH  
VQNGRS

FIGURE 1-6

At254 G307D (SEQ ID NO:38)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
 RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**DK**SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAI DHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKVV  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VQNGRS

At173 G307D (SEQ ID NO:40)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
 NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
 IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
 RKTFAASREE TEKVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**DK**SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAI DHFCI HAGGRAVIDV  
 LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKVV  
 QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
 VQNGRS

Bn399 G307D (SEQ ID NO:42)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLO  
 HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
 DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
 RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
 AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
 ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
 THTGAD**DK**SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
 LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAI DHFCI HAGGRAVIDE  
 LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKA  
 QIALGSGFKC NSAVWVALRN VKASANSWPQ HCIDRYPVKI DSDLSKSKTH  
 VQNGRS

FIGURE 1-7

*Arabidopsis thaliana* FAE1 (SEQ ID NO:1)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
ctcgggttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
gtctagggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggtta  
aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttgggtggggc cgcgattttg ctctctaaca  
agtcggggaga cgggagacgg tccaagtaca agctagtcca cacggtcgga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttta gcgaaaagt tctttttttc gctaccttcg tcgccaagaa  
acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
aacgtttacat agatttgga atacttcac tagctcaatt tggatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gttaagtgt aatagtgcgg ttgggtggc  
tctacgcaat gtcaaggcat cggcaaatag tccttgga cattgcatc  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggtccta attgatgta tctgagtgc aacgtttact  
ttgtctttcc tttcttttat tggttatgaa ttagatgttt actaatgttc  
ctctcttttt cgttataaat aaagaagttc aattcttct atagtttcaa  
acgcgatttt aagcgtttct atttaggttt acatgaattt cttttacaaa  
ccatctttt

FIGURE 2-1



*Brassica napus* elongase KCS (SEQ ID NO:3)

```

atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgtaaacggc gatcgtcgcc ggaaaagcct
atcgggttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg
gatatctttt atcaagtaag aaaagctgat ccttctcgga acggcacgtg
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggg gataataggt ccatgatggg
ttcaaattgc ttgttccgtg ttgggtgggg cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggctg aacgggttaag aaaaacatag caacgttggg tccgttgatt
cttccgttaa gcgagaaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttgga acacttcac tagctcaata tggatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta ataa

```

FIGURE 2-2

*B. napus* elongase KCS (SEQ ID NO:5)

tagagcgtaa	cggaccacaa	aagaggatcc	atacaaatac	atctcatcgc
ttccattact	attctccgac	acacacactg	agcaatgacg	tccattaacg
taaagctcct	ttaccattac	gtcataacca	accttttcaa	cctttgtttc
tttccattaa	cggcgatcgt	cgccggaaaa	gcctatctta	ccatagacga
tcttcaccac	ttatactatt	cctatctcca	acacaacctc	ataaccattg
ctccactctt	ggccttcacc	gttttcgggt	cggttctcta	catcgcaacc
cggcccaaac	cggttttacct	cgtggagtac	tcatgctacc	ttccaccaac
gcattgtaga	tcaagtatct	ccaagggtcat	ggatatcttt	ttccaagtaa
gaaaagctga	tccttctcgg	aacgggcacgt	gcgatgactc	gtcctggcct
gacttcttga	ggaagattca	agaacgttca	ggtctaggcg	atgaaaccca
cgggcccagag	gggctgcttc	aggtccctcc	ccggaagact	tttgcgcgcg
cgcgtgaaga	gacggagcaa	gttatcattg	gtgcgctaga	aaatctattc
aagaacacca	atgttaaccc	taaagatata	ggtatacttg	tggtgaactc
aagcatgttt	aatccaactc	cttcgctctc	cgcgatggtc	gttaacactt
tcaagctccg	aagcaacgta	agaagcttta	accttggtgg	catgggttgt
agtgccggcg	ttatagccat	tgatctagca	aaggacttgt	tgcatgtcca
taaaaatacg	tatgctcttg	tggtgagcac	agagaacatc	acttataaca
tttacgctgg	tgataatagg	tccatgatgg	tttcaaattg	cttggtccgt
gttggtgggg	ccgctatttt	gctctccaac	aagcctagag	atcgtagacg
gtccaagtac	gagctagttc	acacgggttcg	aacgcatacc	ggagctgacg
acaagtcttt	tcgttgcggtg	caacaaggag	acgatgagaa	cggccaaacc
ggagtgagtt	tgtccaagga	cataaccgat	gttgctggtc	gaacggttaa
gaaaaacata	gcaacgctgg	gtccgttgat	tcttccgtta	agcgagaaac
ttcttttttt	cgttaccttc	atgggcaaga	aacttttcaa	agacgaaatc
aaacattatt	acgtcccggg	cttcaagctt	gctatcgacc	atttttgtat
acatgccgga	ggcaaagccg	tgattgatgt	gctagagaag	aacctaggcc
tagcaccgat	cgatgtagag	gcatcaagat	caacgttaca	tagattttgga
aacacttcat	ctagctcaat	atgggtatgag	ttggcataca	tagaacccaa
aggaaggatg	aagaaaggta	ataaagtttg	gcagattgct	ttaggggtcag
gctttaagtg	taacagtgca	gtttgggtgg	ctctaaacaa	tgtcaaagct
tcaacaaata	gtccttgga	acactgcac	gacagatacc	cggttaaaat
tgattctgat	tcaggtaagt	cagagactcg	tgtcccaaac	ggtcggtcct
aataaatgat	gtttgctctc	tttcgtttct	ttttattggt	tataataatt
tgatggccac	gatgtttctc	ttgtttgtta	tgaataaaga	atcccacggt
gttctagtaa	aaaaaaaaa	aaaaaaaaa	aaaaaa	

FIGURE 2-3

At114 (SEQ ID NO:7)

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc gccaccgcat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
 tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa cgtaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggt gataatagggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggctg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgtttacat agatttgga acacttcac tagctcaata tggatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtcccaaacg gtcggtccta a

FIGURE 2-4

At74 (SEQ ID NO:9)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaacccgac ccaaaccggt ttacctcggt gagtactcat  
 gctaccttcc accaacgcat tgtagatcaa gtatctccaa ggatcatggat  
 atcttttata aagtaagaaa agctgatcct tctcggaacg gcacgtgcga  
 tgactcgctg tggcttgact tcttgaggaa gattcaagaa cgttcaggtc  
 taggcgatga aactcacggg cccgaggggc tgcttcagggt ccctcccggg  
 aagacttttg cggcggcgcg tgaagagacg gagcaagtta tcattgggtgc  
 gctagaaaat ctattcaaga acaccaacgt taaccctaaa gatataggta  
 tacttggtgt gaactcaagc atgtttaatc caactccatc gctctccgcg  
 atggctcgta acactttcaa gctccgaagc aacgtaagaa gctttaacct  
 tgggtggcatg gggtgtagtg ccggcggttat agccattgat ctagcaaagg  
 acttggtgca tgtccataaa aatacgtatg ctcttggtgt gagcacagag  
 aacatcactt ataacattta cgctgggtgat aatagggtcca tgatgggttc  
 aaattgcttg ttccgtgttg gtggggcgcg tattttgctc tccaacaagc  
 ctggagatcg tagacggtcc aagtacgagc tagttcacac ggttcgaacg  
 cataccggag ctgacggcaa gtcttttcgt tgcgtgcaac aaggagacga  
 tgagaacggc aaaatcggag tgagtttgct caaggacata accgatgttg  
 ctggtcgaac ggtaagaaa aacatagcaa cggtgggtcc gttgattctt  
 ccgttaagcg agaaacttct ttttttcggt accttcattg gcaagaaact  
 tttcaaagat aaaatcaaac attactacgt cccggatttc aaacttgcta  
 ttgaccattt ttgtatacat gccggaggca gagccgtgat tgatgtgcta  
 gagaagaacc tagccctagc accgatcgat gtagaggcat caagatcaac  
 gttacataga tttggaaaca ctcatctag ctcaatatgg tatgagttgg  
 catacataga agcaaaagga aggatgaaga aaggtaataa agtttggcag  
 attgcttttag ggtcaggctt taagtgtaac agtgcagttt ggggtggctct  
 aaacaatgtc aaagcttcga caaatagtcc ttgggaacac tgcatcgaca  
 gatacccggt caaaattgat tctgattcag gtaagtcaga gactcgtgtc  
 caaaacggtc ggtcctaa

FIGURE 2-5

At114 L91C K92R (SEQ ID NO:11)

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc gccaccgcat **tgacag**gtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
 tgataattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggt gataatagggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataacc gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggctg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgtttacat agatttgga acacttcac tagctcaata tggatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtcccaaacg gtcggtccta a

FIGURE 2-6

At114 K92R (SEQ ID NO:13)

```

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt
tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct
ctcgggttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actcttttgct ttcactgttt tcggtttggt
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt
gttaccttcc gccaccgcat ctcagaggtta gtgtctctaa agtcatggat
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcatggtcgt ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggg gataataggc ccatgatggg
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataacc gagctgacgg caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacgggttaag aaaaacatag caacgttggg tccgttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttgga acacttcac tagctcaata tggatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtcccaaacg gtcggtccta a

```

FIGURE 2-7

At114 G307D (SEQ ID NO:15)

atgacgtccg ttaacggttaa gtccttttac cgttatgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc gccaccgcat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
 tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa cgtaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggg gataataggc ccatgatggg  
 ttcaaattgc ttgttccgtg ttgggtgggg cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacga caagtctttt cgttgcgtgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggctg aacgggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgtttacat agatttgga acacttcac tagctcaata tggatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtccaaaacg gtcggtccta a

FIGURE 2-8

At74 G306D (SEQ ID NO:17)

```

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actctttgct ttcactgttt tcgggttggt
tctctacatc gtaaccgcac ccaaaccggt ttacctcggt gagtactcat
gctaccttcc accaacgcat tgtagatcaa gtatctccaa ggatcatggat
atcttttatc aagtaagaaa agctgatcct tctcggaacg gcacgtgcga
tgactcgctc tggcttgact tcttgaggaa gattcaagaa cgttcaggtc
taggcgatga aactcacggg cccgaggggc tgcttcagggt cctccccggg
aagacttttg cggcggcgcg tgaagagacg gagcaagtta tcattggtgc
gctagaaaat ctattcaaga acaccaacgt taaccctaaa gatataggta
tacttggtgt gaactcaagc atgtttaatc caactccatc gctctccgcg
atgggtcgta acactttcaa gctccgaagc aacgtaagaa gctttaacct
tggtggcatg ggttgtagtg ccggcggttat agccattgat ctagcaaagg
acttggtgca tgtccataaa aatacgtatg ctcttggtgt gagcacagag
aacatcactt ataacattta cgctgggtgat aatagggtcca tgatgggttc
aaattgcttg ttccgtggtg gtggggccgc tattttgctc tccaacaagc
ctggagatcg tagacggtcc aagtacgagc tagttcacac gggtcgaacg
cataccggag ctgacgacaa gtcttttcgt tgcgtgcaac aaggagacga
tgagaacggc aaaatcggag tgagtttgct caaggacata accgatgttg
ctggtcgaac ggttaagaaa aacatagcaa cgttgggtcc gttgattctt
ccgtaagcg agaaacttct ttttttcggt accttcattg gcaagaaact
tttcaaagat aaaatcaaac attactacgt cccggatttc aaacttgcta
ttgaccattt ttgtatacat gccggaggca gagccgtgat tgatgtgcta
gagaagaacc tagccctagc accgatcgat gtagaggcat caagatcaac
gttacataga tttggaaaca cttcatctag ctcaatatgg tatgagttgg
catacataga agcaaaagga aggatgaaga aaggtaataa agtttggcag
attgcttttag ggtcagggtt taagtgtaac agtgcagttt gggtaggtct
aaacaatgtc aaagcttcga caaatagtcc ttgggaacac tgcacgcaca
gatacccggt caaaattgat tctgattcag gtaagtcaga gactcgtgtc
caaaacggtc ggtcctaa

```

FIGURE 2-9



At114 L91C K92R G307D (SEQ ID NO:19)

```

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt
tttcaacctc tgtttggtcc cgtaacggc gttcctcgcc ggaaaagcct
ctcgggttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actctttgct ttcactgttt tcgggttggt
tctctacatc gtaaccgac ccaatccggt ttatctcggt gactactcgt
gttaccttcc gccaccgcat tgacagagtta gtgtctctaa agtcatggat
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg
tgataattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaccct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt
ttcaaattgc ttgttccgtg ttggtggggc cgctatcttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataacc gagctgacga caagctctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttgga acacttcac tagctcaata tggatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg cttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta a

```

FIGURE 2-10

At114 K92R G307D (SEQ ID NO:21)

```

atgacgtccg ttaacggttaa gtccttttac cgttatgtct taaccaactt
tttcaacctc tgtttggtcc cgtaacggc gttcctcgcc ggaaaagcct
ctcgggttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt
gttaccttcc gccaccgcat ctcagaggtta gtgtctctaa agtcatggat
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggccctccc
cgaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt
ttcaaattgc ttgttccgtg ttggtggggc cgctatcttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagtcca cacggttcga
acgcataaccg gagctgacga caagctctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggctg aacgggttaag aaaaacatag caacgttggg tccgttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttgaa acacttcac tagctcaata tggatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta a

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FIGURE 2-11

At254 (SEQ ID NO:23)

atgacgtccg ttaacggttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaacggc gttcctcgcc ggaaaagcct  
 ctgggttac cataaacgat ctccacaacc tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
 gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
 cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
 gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
 gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
 tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggtca  
 aagacttggt gcatgttcat aaaaacactt atgctctcgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacgg caagtctttt cgttgcggtc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggtt ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgtttacat agatttgga acacttcac tagctcaata tggatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg cttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtcccaaacg gtcggtccta a

FIGURE 2-12

At173 (SEQ ID NO:25)

atgacgtccg ttaacggttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcggtcag  
 gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
 cggaagactt ttgcagcgct acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattca agaacaccaa cgtaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttgtt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgtcgtt gataataggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgttacat agatttgga acacttcac tagctcaata tggatatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtccaaaacg gtcggtccta a

FIGURE 2-13

Bn176 (SEQ ID NO:27)

atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct  
 tttcaacctt tgcttctttc cgtaaacggc gatcgctgcc ggaaaagcct  
 atcggcttac catagacgat cttcaccact tatactattc ctatctccaa  
 cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc  
 ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact  
 catgctacct tccaccaacg cattgtagat caagtatctc caaggctcatg  
 gatattcttt atcaagtaag aaaagctgat ccttctcgga acggcacgtg  
 cgatgactcg tcgtaggctg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
aagacttgtt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
agtcgggaga ccggagacgg tccaagtaca agctagttca cacggtccga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
tgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttaa gcgaaaagtt tctttttttc gctaccttcg tcgccaagaa  
acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
aacgttacat agatttggga atacttcac tagctcaatt tggatatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc  
tctacgcaat gtcaaggcat cggcaaata tagcttggcaa cattgcatcg  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggtccta a

FIGURE 2-14

At399 (SEQ ID NO:29)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
 ttccaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
 gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
 cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
 gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
 gctatggctc ttaatacttt caagctccga agcaacatca aaagctttaa  
 tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
 aagacttgtt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
 gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
 tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
 agtcgggaga cgggagacgg tccaagtaca agctagttca cacgggtccga  
 acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
 cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
 ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
 ctctctttaa gcgaaaagt tctttttttc gctaccttcg tcgccaagaa  
 acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
 ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgttacat agatttgga acacttcac tagctcaata tggatatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtccaaaacg gtcggtccta a

FIGURE 2-15

Bn399 (SEQ ID NO:31)

atgacgtcca ttaacgttaa gtccttttac cattacgtca taaccaacct  
 tttcaacctt tgcttctttc cgtaaaccggc gatcgtcgcc ggaaaagcct  
 atcggcttac catagacgat cttcaccact tatactattc ctatctccaa  
 cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc  
 ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact  
 catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg  
 gatattctttt atcaagtaag aaaagctgat ccttctcggg acggcacgtg  
 cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgtgtgt gataataggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataaccg gagctgacgg caagtctttt cgttgcgctgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgaagtt gtccaaggac ataaccgatg  
 ttgctggctg aacgggtaag aaaaacatag caacgttggg tccgttgatt  
 cttccggtta gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 actttttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gatcgatgag  
 ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
aacgttacat agatttggga atacttcac tagctcaatt tggatatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc  
tctacgcaat gtcaaggcat cggcaaatag tccttggcaa cattgcatcg  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggtccta a

FIGURE 2-16

Bn G307D (SEQ ID NO:33)

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atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgттаacggc gatcgtcgcc ggaaaagcct
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg
gatatctttt atcaagtaag aaaagctgat ccttctcgga acggcacgtg
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atggggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggg gataataggt ccatgatggt
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataacc gagctgacga caagtccttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttggaa acacttcac tagctcaata tgggtatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta ataa

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FIGURE 2-17



At K92R (SEQ ID NO:35)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggtttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct tteactgttt tcggtttggt  
 tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgat ct**agag**gtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tctcgcctcg atttctgag gaagattcaa gagcgttcag  
 gtctaggtga tgagacgtac agtctgagg gactcattca cgtaccaccg  
 cgggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
 gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
 gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
 tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggtta  
 aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
 gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
 tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
 agtcgggaga cgggagacgg tccaagtaca agctagttca cacggtccga  
 acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
 cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
 ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
 ctctctttaa gcgaaaagtt tctttttttc gctaccttcg tcgccaagaa  
 acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
 ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
 ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
 aacgttacat agatttggga atacttcac tagctcaatt tggatgaat  
 tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
 cagattgctt taggatcagg gttaagtgt aatagtgcgg tttgggtggc  
 tctacgcaat gtcaaggcat cggcaaata tagcttgcaa cattgcatcg  
 atagatatcc gggtaaaatt gattctgatt tgtcaaagtc aaagactcat  
 gtccaaaacg gtcggtccta atttgatgta tctgagtgcc aacgtttact  
 ttgtctttcc tttcttttat tgggtatgaa ttagatgttt actaatgttc  
 ctctcttttt cgttataaat aaagaagttc aattcttcct atagtttcaa  
 acgcgatttt aagcgtttct atttaggttt acatgaattt cttttacaaa  
 ccatctttt

FIGURE 2-18

At254 G307D (SEQ ID NO:37)

atgacgtccg ttaacggttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tggttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tcctcgctcg atttctgag gaagattcaa gagcgttcag  
 gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
 cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
 gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
 gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
 tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
 aagacttgtt gcatgttcat aaaaacactt atgctctcgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
 ttcaaattgc ttgttcgctg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacga **ca**agtcctttt cgttgctgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggtt ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgtttacat agatttgga acacttcac tagctcaata tggatgagt  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtccaaaacg gtcggtccta a

FIGURE 2-19

At173 G307D (SEQ ID NO:39)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
 tttcaacctc tgtttggtcc cgtaacggc gttcctcgcc ggaaaagcct  
 ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
 aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
 tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
 gttaccttcc accaccgat ctcaaagtta gtgtctctaa agtcatggat  
 attttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
 tgatgatccg tcctcgctcg atttctgag gaagattcaa gagcgttcag  
 gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
 cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
 tgcgctcgaa aatctattca agaacaccaa cgtaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgtctctc  
 gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttgtt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgtgtgt gataataggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataccg gagctgacga **ca**agtccttt cgttgcggtc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
 ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
 ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
 aacgttacat agatttgga acacttcac tagctcaata tggatgatg  
 tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttg  
 cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
 tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
 acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
 gtccaaaacg gtcggtccta a

FIGURE 2-20

Bn399 G307D (SEQ ID NO:41)

atgacgtcca ttaacgttaa gtccttttac cattacgtca taaccaacct  
 tttcaacctt tgcttctttc cgtaaaccgc gatcgtcgcc ggaaaagcct  
 atcggcttac catagacgat cttcaccact tatactattc ctatctccaa  
 cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc  
 ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact  
 catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg  
 gatatctttt atcaagtaag aaaagctgat ccttctcgga acggcacgtg  
 cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
 gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
 cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
 tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag  
 gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
 gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
 ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
 aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
 gagaacatca cttataacat ttacgctggg gataataggt ccatgatggt  
 ttcaaattgc ttgttccgtg ttgggtggggc cgctattttg ctctccaaca  
 agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
 acgcataaccg gagctgacga **ca**agtcctttt cgttgcgtgc aacaaggaga  
 cgatgagaac ggcaaaatcg gagtgaagtt gtccaaggac ataaccgatg  
 ttgctggctg aacgggttaag aaaaacatag caacgttggg tccgttgatt  
 cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
 acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
 ctattgacca tttttgtata catgccggag gcagagccgt gatcgatgag  
 ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
 aacgttacat agatttggga atacttcac tagctcaatt tggatatgaat  
 tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
 cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc  
 tctacgcaat gtcaaggcat cggcaaatag tccttggcaa cattgcatcg  
 atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
 gtccaaaacg gtcggtccta a

FIGURE 2-21